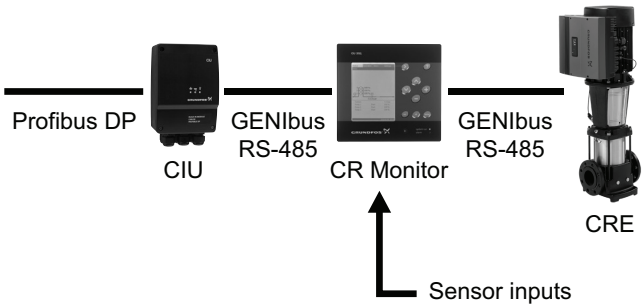
Grundfos CIU 150

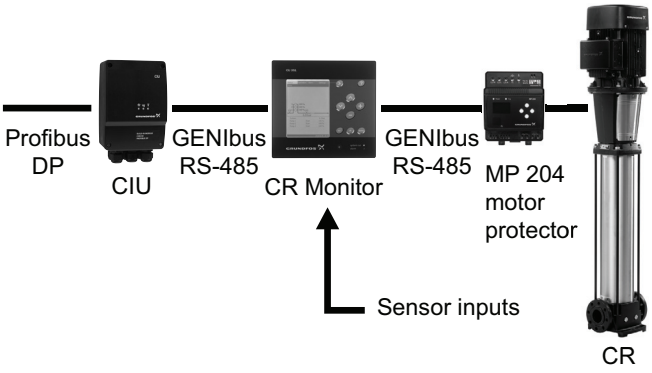
Profibus DP for Grundfos CR monitor

(GB) Functional profile and user manual

Grundfos CR Monitor and CRE



Grundfos CR Monitor and MP 204 with CR



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1. Symbols used in this document

Note ***Notes or instructions that make the job easier and ensure safe operation.***

2. Introduction

2.1 About this functional profile

This functional profile describes the CIU 150 (Profibus Communication Interface Unit 150) for the Grundfos CR Monitor.

In the following, the CIU 150 is referred to as "communication interface", and the Grundfos CR Monitor is referred to as "controller".

The data in this document are subject to change without prior notice. Grundfos cannot be held responsible for any problems caused directly or indirectly by using information in this functional profile.

2.2 Profibus DP-V0

The Profibus interface conforms to the Profibus DP-V0 standard for cyclic data transmission.

The option of setting the Profibus address via bus is not supported as the CIM 150 has two switches for setting the address.

2.3 Profibus DP-V1

Only the diagnostic part and the extra 3 bytes of parameterisation data are supported. Acyclic data transmission is not supported.

2.4 Assumptions

This functional profile assumes that the reader is familiar with commissioning and programming Profibus DP devices. The reader should also have some basic knowledge of the Profibus protocol and technical specifications.

It is also assumed that an existing Profibus network with a Profibus master is present

2.5 Definitions and abbreviations

CIM 150	Communication Interface Module
CIU 150	Communication Interface Unit
CR	Grundfos multistage centrifugal pump
CRC	Cyclic Redundancy Check, a data error detection method
CRE	Grundfos multistage centrifugal pump with variable-speed motor
Enumeration	A list of values
GENIbus	Proprietary Grundfos fieldbus standard
H	Pressure (Head)
IO 351	Grundfos Input/Output module
LED	Light-Emitting Diode
MP 204	Electronic Grundfos Motor Protector
Q	Flow
Transmission speed	Bits transferred per second.

2.6 System diagrams

The CR Monitor offers advanced monitoring of a Grundfos CRE pump or a Grundfos MP 204 motor protector connected to a CR pump.

The system diagrams give an overview of how to connect the CIU 150 to the Grundfos CR Monitor that is to be connected to a Profibus network. A CR Monitor is connected to either a Grundfos CRE pump or a Grundfos MP 204 connected for a CR pump. The CIU 150 has a number of sensor inputs that can be connected directly to sensors, or it can get sensor inputs from a Grundfos IO 351 module.

The CIU 150 offers a Profibus connection to the CR Monitor. Note that the CR Monitor must have a GENIbus RS-485 module installed.

The CIU 150 solution is a box with a power supply module and a CIM 150 module. The CIU 150 can either be mounted on a DIN rail or on a wall. See fig. 1 or 2.

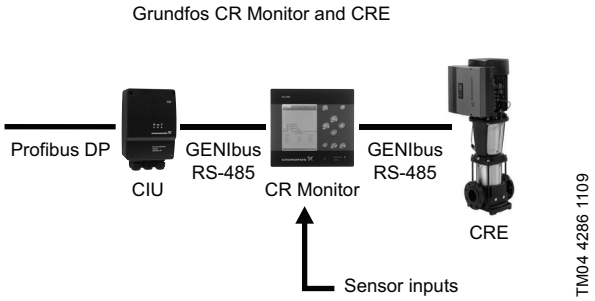

Fig. 1 CR Monitor connected to a CRE pump

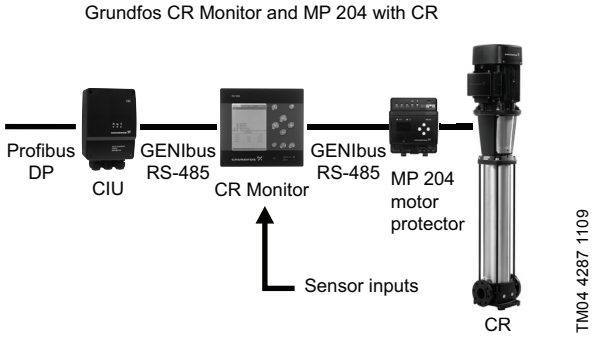

Fig. 2 CR Monitor connected to an MP 204 which is connected to a CR pump

2.7 Specifications

The table below gives an overview of the specifications for the Grundfos CIU 150. For further details, please refer to the specific sections of this functional profile.

General data		
GENIbus visual diagnostics	LED2	Off, constantly green, flashing red, constantly red. See section *4.4.2 LED2 – internal communication*.
Communication Interface Unit (CIU 150)		
Power supply	24-240V AC/DC	Located in the CIU 150.
GENIbus connection type	RS-485	
GENIbus wire configuration	Three-wire + screen	Conductors: A, B and Y.
Profibus specifications		
Data protocol	Profibus DP	
Profibus implementation class	DP-V0	
Profibus connector	Screw-type terminal	
Profibus connection type	RS-485	
Profibus wire configuration	Two-wire	Lines: A, B, DGND, VP (+5 V).
Maximum cable length	100 m @ 12 Mbps	
Slave address	1-126	Set via rotary switches SW3 and SW4. See section *4.3 Termination resistors*.
Line termination	On or Off	Set via DIP switches SW1 and SW2. See section *4.3 Termination resistors*.
Supported transmission speeds	9600 bps to 12 Mbps	See section *4.1.1 Data transmission speeds and cable length*.
Profibus visual diagnostics	LED1	Profibus extended diagnostics. See section *4.4.1 LED1 – Profibus communication*.
Maximum number of Profibus devices	32	Up to 125 slaves if repeaters are used.

3. Profibus interface

3.1 Profibus topology

The Grundfos CIM/CIU 150 is connected as a Profibus slave directly to the Profibus network.

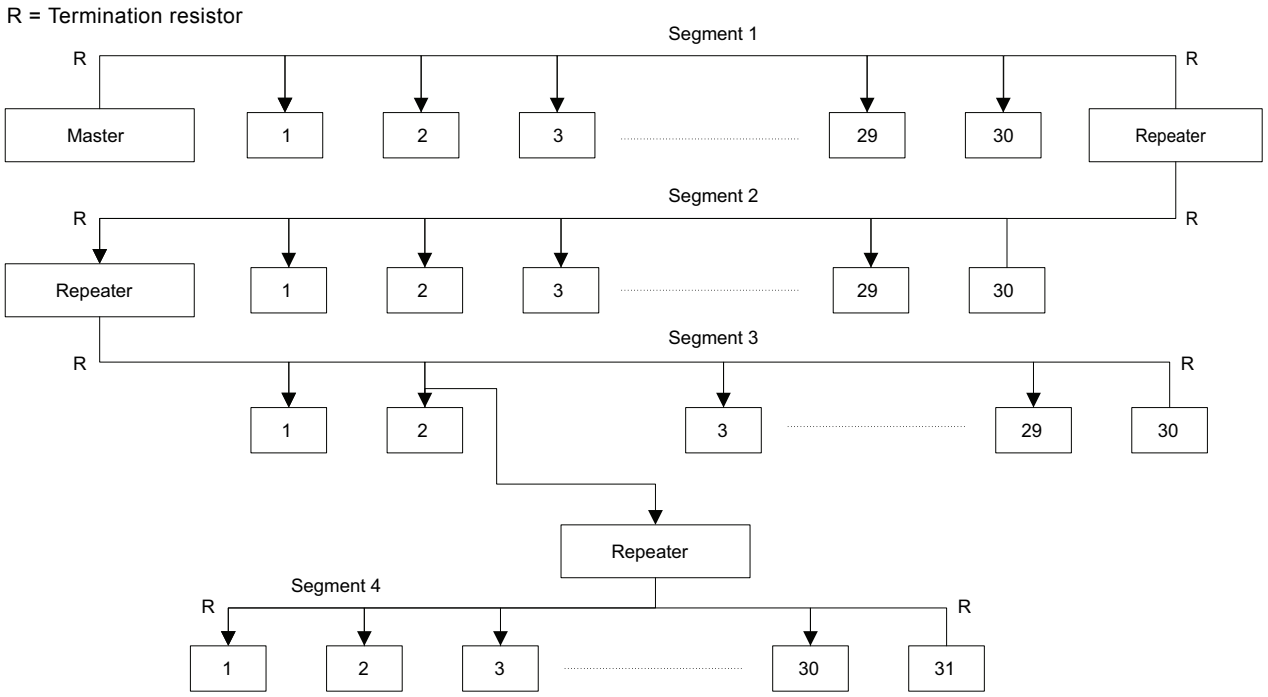

Fig. 3 Example of Profibus topology

Up to 32 Profibus devices can be connected to each segment. As repeaters and master also count as devices, the maximum number of Profibus slaves (stations) is 30.

Up to 126 Profibus devices (125 slaves and 1 master) can be connected to one network.

To connect two networks, a coupler is required.

3.2 Earthing

It is very important to connect all Profibus devices on a network to the same earth potential. It must be a low-impedance earth. If there is a long distance between the Profibus devices, it might be necessary to use several potential equalisation cables.

3.3 Bus connection diagram

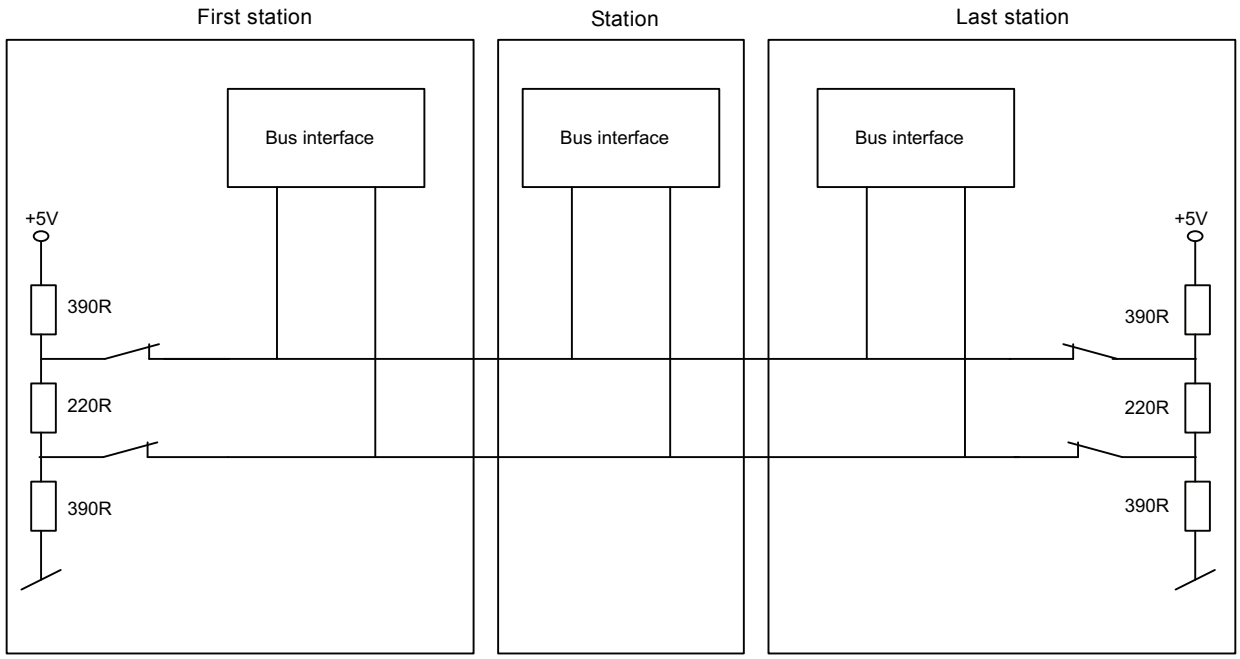

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Fig. 4 Bus connection and termination

4. CIM 150 Profibus module

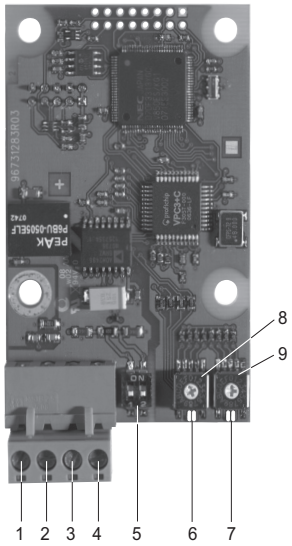

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Fig. 5 CIM 150 Profibus module

Pos.	Designation	Description
1	B (RxD/TxD-P)	Profibus terminal B (positive data signal)
2	A (RxD/TxD-N)	Profibus terminal A (negative data signal)
3	DGND	Profibus terminal DGND (external termination)
4	VP	+5 VDC (external termination)
5	SW1/SW2	On/off switches for termination resistors
6	LED1	Red/green status LED for Profibus communication
7	LED2	Red/green status LED for internal communication between the CIM 150 and the CR Monitor
8	SW3	Hex switch for setting the Profibus address (four most significant bits)
9	SW4	Hex switch for setting the Profibus address (four least significant bits)

4.1 Connecting to the Profibus network

4.1.1 Data transmission speeds and cable length

Grundfos recommends to use a cable according to IEC 61158.

Example

Siemens, 6XV1 830-0EH10.

Cable length

kbits/s	Maximum cable length
	[m/ft]
9.6	1200/4000
19.2	1200/4000
45.45	1200/4000
93.75	1000/3300
187.5	1000/3300
500	400/1300
1500	200/660
3000	100/330
6000	100/330
12000	100/330

Fitting the cable

Procedure:

See fig. 6.

1. Connect the red conductor(s) to terminal B (pos. 1).
2. Connect the green conductor(s) to terminal A (pos. 2).
3. Connect the cable screens to earth via the earth clamp (pos. 3)

Note

It is important to connect the screen to earth through the earth clamp and to connect the screen to earth in all units connected to the bus line.

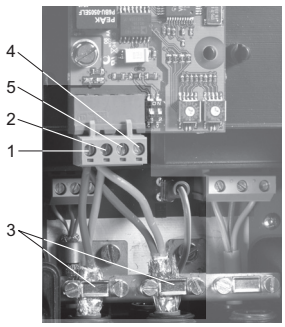

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Fig. 6 Connecting to the Profibus network

Pos.	Description
1	Profibus terminal B
2	Profibus terminal A
3	Earth clamp
4	VP +5 VDC (external termination)
5	DGND (external termination)

4.2 Setting the Profibus address

The CIM 150 Profibus module has two hexadecimal rotary switches for setting the Profibus address. The two switches are used for setting the four most significant bits (SW3) and the four least significant bits (SW4), respectively. See fig. 7.

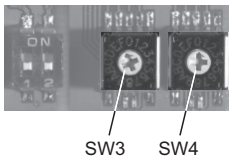

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Fig. 7 Setting the Profibus address

Profibus addresses

The table below shows examples of Profibus address settings.

Note ***The Profibus address must be set decimally from 1 to 126.***

Profibus address	SW3	SW4
8	0	8
20	1	4
31	1	F
126	7	E

The CIU 150 must be restarted for an address change to take effect. The slave address is set using the listed values.

For a complete overview of Profibus addresses, see section *11. Profibus address*.

4.3 Termination resistors

The termination resistors are fitted on the CIM 150 Profibus module. See fig. 8.

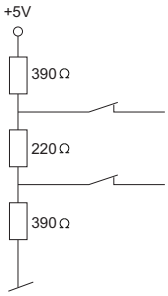

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Fig. 8 Internal termination resistors

The CIM 150 has a DIP switch with two switches (SW1 and SW2) for cutting the termination resistors in and out. Figure 9 shows the DIP switches in cut-out state.

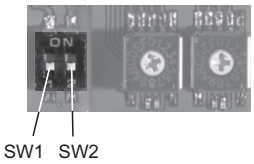

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Fig. 9 Cutting termination resistors in and out

DIP switch settings

Status	SW1	SW2
Cut-in	ON	ON
Cut-out	OFF	OFF
Undefined state	ON	OFF
	OFF	ON

Note ***To ensure a stable and reliable communication, it is important that only the termination resistors of the first and last units in the Profibus network are cut in. See fig. 4.***

4.4 LEDs

The CIM/CIU 150 has two LEDs.

- Red/green status LED (LED1) for Profibus communication between master and slave
- Red/green status LED (LED2) for internal communication between the CIM/CIU 150 and the CR Monitor.

4.4.1 LED1 – Profibus communication

Status	Description
Off	The CIM/CIU 150 has been switched off.
Constantly green	The CIM/CIU 150 is ready for data transmission (Data Exchange State).
Flashing red	Wrong or missing Profibus configuration.
Constantly red	CIM 150 module fault.

4.4.2 LED2 – internal communication

Status	Description
Off	The CIM/CIU 150 has been switched off, or is starting up.
Flashing red	No internal communication between the CIM/CIU 150 and the CR Monitor.
Constantly red	The CIM/CIU 150 does not support the CR Monitor connected.
Constantly green	Internal communication between the CIM/CIU 150 and the CR Monitor is OK.

Note ***During start-up, there may be a delay of up to 5 seconds before the LED2 status is updated.***

Note ***The CR Monitor must have finished its start-up sequence before the LED2 can be used for status. This means that a certain delay may occur before the LED2 turns green after start-up of the CR Monitor.***

4.5 Communication watchdog

The Profibus communication watchdog must be enabled with a commissioning tool, e.g. Siemens STEP7®. If the Profibus communication breaks down, the CIM/CIU 150 will set the system to Local mode. Therefore, it is imperative that the person or persons responsible for commissioning and maintenance of the entire system configure the Local operating mode correctly.

5. Functional profile

5.1 Data types

The Grundfos CIM 150 supports the following data types.

All data types, except for data type 10, comply with specification IEC 61158-6 standard data types for use in Profibus profiles.

Data type	Description
1	Boolean
2	Integer 8
3	Integer 16
4	Integer 32
5	Unsigned 8
6	Unsigned 16
7	Unsigned 32
8	Floating point
9	Visible string
10	Non-standard

All multi-byte data types are transmitted with MSB (Most Significant Byte) as illustrated below.

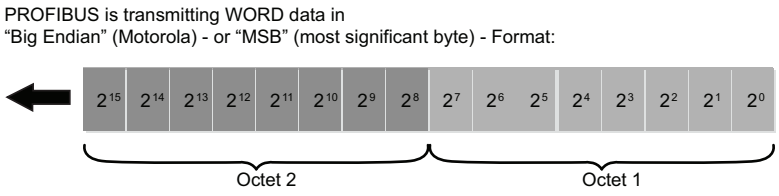
PROFIBUS is transmitting WORD data in
“Big Endian” (Motorola) - or “MSB” (most significant byte) - Format:
2^15 2^14 2^13 2^12 2^11 2^10 2^9 2^8 2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0
Octet 2
Octet 1

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Fig. 10 Data format

6. Control module

This module is used to control the pump/MP 204 connected to the CR Monitor.

Note ***Some of the control bits only apply to a CRE pump, but not to an MP 204.***

Profibus direction: Outputs

GSD module number: 2

Control module overview

Byte no.	Bit no.	Name	CRE pump	CR + MP 204
		Control bits		
1	7	PumpKick*		
	6	Not used		
	5	Not used		
	4	CopyToLocal*		
	3	Direction*		
	2	ResetFault	•	•
	1	OnOff	•	•
	0	RemoteAccessReq	•	•
2	0-7	**ControlMode (enumeration)**	•	•
		0: CONST_SPEED**		
		1: CONST_FREQ		
		2: CONST_POWER**		
		3: CONST_HEAD**		
		4: CONST_PRESSURE		
		5: CONST_DIFFPRESS**		
		6: VAR_DIFFPRESS**		
		7: CONST_FLOW**		
		8: CONST_TEMP**		
		9: CONST_TEMPDIFF**		
		10: CONST_LEV**		
		128: AUTO_PRESS_MODE**		
3	0-7	**OperationMode (enumeration)**	•	•
		0: Auto-control		
		1: ClosedLoopStandardPID**		
		2. Advanced**		
		3. Standby**		
		4: OpenLoopMin		
		5: OpenLoopValue**		
		6: OpenLoopMax		
		7: ClosedLoopMin**		
		8: ClosedLoopMax**		
		9: Test**		
		10: Calibration**		
4, 5	0-7	Setpoint (0.01 %)	•	

* This functionality is not implemented in the CR Monitor. Therefore, it will have no effect writing to this bit.

** Not supported.
This functionality is not implemented in the CR Monitor. Therefore, setting this mode will have no effect.

6.1 Byte no. 1

6.1.1 Resetfault

If the pump/MP 204 connected to the CR Monitor stops because of an alarm, the user can set this bit to logical 1 in order to attempt to reset the alarm. The alarm will be cleared, if possible.

Not all alarms can be cleared at once. If, for instance, there is an overtemperature alarm, the alarm can only be cleared when the temperature is below the overtemperature alarm threshold. The reset will occur on the rising edge of this bit.

6.1.2 OnOff

If this bit is set to logical 1, the pump connected to the CR Monitor will start.

If the bit is set to logical 0, the pump connected to the CR Monitor stops.

6.1.3 RemoteAccessReq

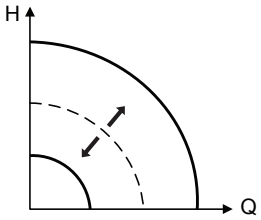
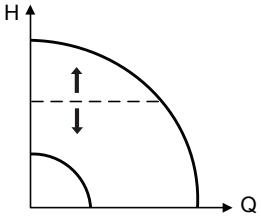
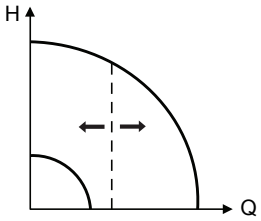
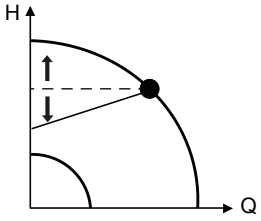
In order to remotely control the pump connected to the CR Monitor via Profibus (i.e. start, stop, etc.), this bit must be set to logical 1.

If the bit is set to logical 0, the pump will operate in local mode. Local mode is determined by the mode set via the control panel on the pump.

6.2 Byte no. 2

Control modes

The supported control modes are described further in this section.

Control modes	Description	Illustration
• CONST_SPEED (0) • CONST_FREQ (1)	**Open loop** The setpoint of the CRE pump will be interpreted as setpoint for the pump speed. The setpoint value is a percentage of the maximum speed of the pump. No sensor is required in these modes.	 TM04 2289 2208
• CONST_HEAD (3) • CONST_PRESSURE (4) • CONST_DIFFPRESS (5)	**Closed loop** The setpoint of the CRE pump will be interpreted as setpoint for the pressure. The controller in the pump will change the pump speed so that the pressure is constant, regardless of the flow. A pressure sensor is required.	 TM04 2290 2208
• CONST_FLOW (7) • CONST_TEMP (8) • CONST_LEV (10)	**Closed loop** The setpoint of the CRE pump will be interpreted as setpoint for the flow, temperature or level. CONST_FLOW is illustrated to the right. A relevant sensor is required: • a temperature sensor for temperature control, • a level sensor for level control and • a flow sensor for flow control.	 TM04 2288 2208
• VAR_DIFFPRESS (6)	**Closed loop** The setpoint of the CRE pump will be interpreted as basic setpoint for the VAR_DIFFPRESS mode (the black dot in the drawing). This control mode is only available on TPE Series 2000. A pressure sensor is required.	 TM04 2291 2208

H = Pressure (Head)

Q = Flow

Important notes to control mode

Only valid control modes will be accepted.

If the pump is for instance configured as a TPE Series 2000 pump and the control mode is changed to CONST_TEMP, the pump will not change its control mode because it is not possible for a TPE Series 2000 pump to run in this mode. The mode will then be the last valid control mode set via Profibus.

6.3 Byte no. 3

Operating modes

This section describes the possible operating modes for the pump connected to the CR Monitor.

6.3.1 Auto-control (0)

The pump connected to the CR Monitor is in normal operating mode. The pump speed is controlled via the pump setpoint.

6.3.2 OpenLoopMin (4)

The pump connected to the CR Monitor is running at minimum speed.

6.3.3 OpenLoopMax (6)

The pump connected to the CR Monitor is running at maximum speed.

6.4 Bytes nos 4 and 5

Setpoint

The setpoint accepts values ranging from 0 to 10000 (0 % to 100 %). This is illustrated in fig. 11. The setpoint is a percentage of the maximum setpoint or sensor maximum (max. = 100 %). The setpoint value can represent speed, pressure, flow, etc., depending on the selected control mode.

A setpoint of 0 does not imply a stop.

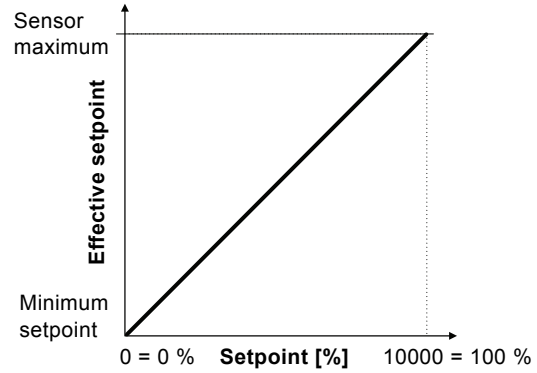


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Fig. 11 Setpoint

6.4.1 Setpoint examples

Closed loop

If the control mode is set to CONST_PRESS (closed loop), and the pressure sensor is in the range of 0 to 10 bar, a setpoint of 80 % will result in an effective setpoint of 8 bar.

If the sensor range was 0 to 16 bar, a 50 % setpoint would be 8 bar, a 25 % setpoint would be 4 bar, and so on.

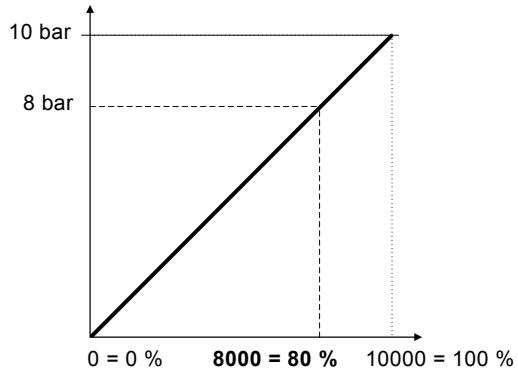

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Fig. 12 Constant pressure

Open loop

If the control mode is set to CONST_FREQ (open loop), the setpoint is interpreted as setpoint for the system performance.

The example shows that a 50 % setpoint equals a 50 % system performance.

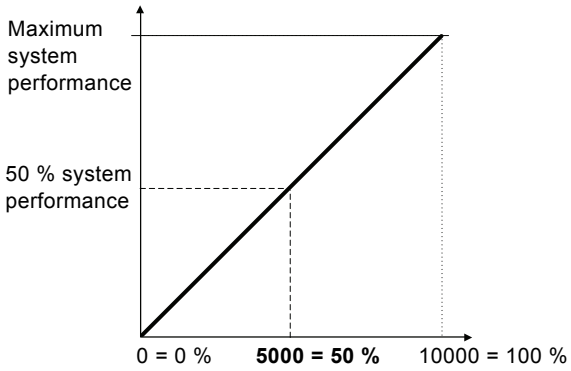

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Fig. 13 Constant frequency

7. Status module

This is status data that can be read in the CR Monitor.

Not all status values are available for the MP 204. See the table below.

Profibus direction: Inputs

GSD module number: 1

Byte no.	Bit no.	Name	CRE pump	CR + MP 204
		Control bits		
1	7	AtMinSpeed	•	
	6	Standby*		
	5	AtMaxSpeed	•	
	4	PumpActive*		
	3	Warning	•	•
	2	Fault	•	•
	1	OnOff	•	•
	0	AccessMode	•	•
2	7	Direction*		
	6	Rotation*		
	5	AtMaxPower*		
	4	SetpointInfluence*		
	3	ResetFaultAck	•	•
	2	0		
	1	0		
	0	0		
3, 4	0-7	ProcessFeedback (%)	•	
5	0-7	**ControlMode (enumeration)**	•	•
		0: CONST_SPEED**		
		1: CONST_FREQ		
		2: CONST_POWER**		
		3: CONST_HEAD**		
		4: CONST_PRESSURE		
		5: CONST_DIFFPRESS**		
		6: VAR_DIFFPRESS**		
		7: CONST_FLOW**		
		8: CONST_TEMP**		
		9: CONST_TEMPDIFF**		
		10: CONST_LEV**		
		128: AUTO_PRESS_MODE		
6	0-7	**OperationMode (enumeration)**	•	•
		0: Auto-control		
		1: ClosedLoopStandardPID**		
		2: Advanced**		
		3: Standby**		
		4: OpenLoopMin		
		5: OpenLoopValue**		
		6: OpenLoopMax		
		7: ClosedLoopMin**		
		8: ClosedLoopMax**		
		9: Test**		
		10: Calibration**		

* This functionality is not implemented in the CR Monitor. Therefore, this bit will always read logical zero (0).

** Modes not supported.

7.1 Byte no. 1

7.1.1 AtMinSpeed

The pump connected to the CR Monitor is running at minimum speed.

This bit is set to logical 1 when the pump is running at minimum speed.

7.1.2 AtMaxSpeed

The pump connected to the CR Monitor is running at maximum speed.

This bit is set to logical 1 when the pump is running at maximum speed.

7.1.3 Warning

If there is a warning in the CR Monitor or pump/MP 204, this bit will be set to logical 1.

If there is a warning, the pump will continue in its current operating mode.

7.1.4 Fault

If there is fault in the CR Monitor or pump/MP 204, this bit will be set to logical 1.

The pump connected to the CR Monitor will stop, and the master must try to reset the fault with ResetFault. This bit will only be cleared on a ResetFault if the fault is no longer present.

7.1.5 OnOff

This bit shows if the pump connected to the CR Monitor is on or off (started or stopped).

If this bit is logical 1, the pump is started.

If the bit is logical 0, the pump is stopped.

7.1.6 AccessMode

If this bit is logical 1, the pump connected to the CR Monitor is controlled via Profibus.

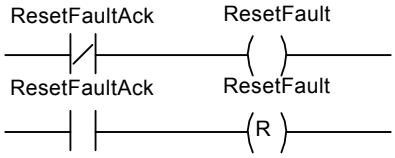
If the bit is logical 0, the pump connected to the CR Monitor is in local control mode.

7.2 Byte no. 2

7.2.1 ResetFaultAck

This bit will be set when a ResetFault has been accepted by the CIM/CIU 150, and the ResetFault bit can be cleared by the user.

The ResetFaultAck bit will then be cleared to 0 by the CIM/CIU 150, and a new fault reset can be attempted by raising the FaultReset bit again. A simple example in Ladder logic is illustrated below.



TM04 2783 2908

Fig. 14 Resetting fault and acknowledgement

7.3 Bytes nos 3 and 4

Process feedback from the CR Monitor in percent.

7.4 Byte no. 5

7.4.1 ControlMode

This byte reflects the control mode the pump connected to the CR Monitor is actually operating in. So this is the actual control mode as a reflection of the control mode set in Control module, byte 2.

7.5 Byte no. 6

7.5.1 OperationMode

This byte reflects the operating mode the pump connected to the CR Monitor is actually operating in. So this is the actual operating mode as a reflection of the operating mode set in Control module, byte 3.

8. Measurement modules

This is measurement data that can be read from the CR Monitor/pump/MP 204. Product markings in the columns to the right indicate possible origin of each data point.

Profibus direction: Inputs.

Module no.	Name	Data type	Unit	Description	CR Monitor	CRE pump	MP 204 + CR
3	WarningCode	5	unscaled	See section *10. Grundfos alarm and warning codes*.	•	•	•
4	FaultCode	5	unscaled	See section *10. Grundfos alarm and warning codes*.	•	•	•
5	MonitorLearning	5	unscaled	**Bits Description** 0: Learning activated 1: Learning operating 2: Data quality flag	•		
6	SystemMode	5	unscaled	Indicates which state the system is in. Enumerated value: 0: Normal 1: Power-up 4: Event action/alarm standby	•		
7	MonthsToBearingService	5	unscaled	Indicates how many months there are to bearing service. The value of 24 means 24 months or more.		•	
8	BearingServiceType	5	unscaled	Indicates which kind of service the bearings need. Enumerated value: 0: Lubrication of bearings 1: Change of bearings FF_H: Invalid information		•	
9	MonitorAlarms	7	bits	**Bits Description** 0: Maximum inlet pressure alarm limit exceeded 1: Minimum inlet pressure alarm limit exceeded 2: Maximum discharge pressure alarm limit exceeded 3: Minimum discharge pressure alarm limit exceeded 4: Maximum differential-pressure alarm limit exceeded 5: Minimum differential-pressure alarm limit exceeded 6: Maximum flow alarm limit exceeded 7: Minimum flow alarm limit exceeded 8: Maximum supply voltage alarm limit exceeded 9: Minimum supply voltage alarm limit exceeded 10: Maximum speed alarm limit exceeded 11: Minimum speed alarm limit exceeded 12: Maximum power alarm limit exceeded 13: Minimum power alarm limit exceeded 14: Minimum efficiency alarm limit exceeded 15: Minimum cavitation alarm limit exceeded 16: Maximum Q, H alarm limit exceeded 17: Maximum Q, P alarm limit exceeded 18: Maximum operating hours trip counter alarm limit exceeded 19: Start trip counter alarm limit exceeded 20: Maximum lubrication time alarm limit exceeded 21: Reserved 22: Reserved 23: Pump fault – System mode = alarm standby/event action 24: Number of allowed alarms/hour exceeded 25: Number of allowed alarms/day exceeded 26: External fault (CU 351) 27: Reserved 28: Reserved 29: Reserved 30: Reserved 31: Reserved.	•		

Module no.	Name	Data type	Unit	Description	CR Monitor	CRE pump	MP 204 + CR
10	MonitorWarnings	7	bits	**Bits** **Description** 0: Maximum inlet pressure warning limit exceeded 1: Minimum inlet pressure warning limit exceeded 2: Maximum discharge pressure warning limit exceeded 3: Minimum discharge pressure warning limit exceeded 4: Maximum differential-pressure warning limit exceeded 5: Minimum differential-pressure warning limit exceeded 6: Maximum flow warning limit exceeded 7: Minimum flow warning limit exceeded 8: Maximum supply voltage warning limit exceeded 9: Minimum supply voltage warning limit exceeded 10: Maximum speed warning limit exceeded 11: Minimum speed warning limit exceeded 12: Maximum power warning limit exceeded 13: Minimum power warning limit exceeded 14: Minimum efficiency warning limit exceeded 15: Minimum cavitation warning limit exceeded 16: Maximum Q, H warning limit exceeded 17: Maximum Q, P warning limit exceeded 18: Maximum operating hours trip counter warning limit exceeded 19: Start trip counter warning limit exceeded 20: Maximum lubrication time warning limit exceeded 21: Reserved 22: Reserved 23: Reserved 24: Reserved 25: Reserved 26: Reserved 27: Reserved 28: Performance requirement cannot be met (learning never steady) 29: Process out of range (pump operates outside pump model range) 30: Reserved 31: Reserved.	•		
11	Mp204Warnings	7	bits	**Bits** **Description** 0: Maximum voltage warning: Three-phase motor: v12, v23, 31>(100 %+v_max_warn)*v_nom/100 % 1-ph. motor: v_phase>(100%+v_max_warn)*v_nom/100 % 1: Minimum voltage warnings: Three-phase motor: v12, v23, v31<(100 %-v_min_warn)*v_nom/ 100 % Single-phase motor: v_phase<(100 %-v_min_warn)*v_nom/100 % 2: Maximum line current warning: Three-phase motor: i1, i2, i3>i_line_max_warn v: i_line>i_line_max_warn 3: Minimum line current warnings: Three-phase motor: i1,i2,i3<(100 %-i_min_warn)*i_line_max_warn/100 % Single-phase motor: i_line<(100 %-i_min_warn)*i_line_max_warn/100 % 4: Line current asymmetry warning (i_asym>i_asym_max_warn) 5: Reserved 6: Reserved 7: Reserved 8: Insulation resistance warning (r_insulation<r_insulation_warn) 9: Motor temperature (Tempcon) warning (t_mo1>t_mo1_warn) 10: Motor temperature (PT resistor) warning (t_mo2>t_mo2_warn) 11: Reserved 12: Maximum cos φ warning limit (cos_phi>cos_phi_max_warn) 13: Minimum cos φ warning limit (cos_phi<cos_phi_min_warn) 14: Starts per hour warning (starts_per_h>starts_per_h_warn) 15: Reserved 16: Start capacitor min. warning: c_start<(100 %-c_start_min_warn)*c_start_ref/100 % 17: Run capacitor min. warning: c_run<(100 %-c_run_min_warn)*c_run_ref/100 % 18: Reserved 19: Tempcon sensor signal fault warning 20: Pt sensor signal fault warning 21: Service warning: t_run_trip_cnt > t_run_trip_warn 22: Load continues even if the motor has been switched off 23: Reserved 24: Reserved 25: Reserved 26: Reserved 27: Reserved 28: Reserved 29: Reserved 30: Reserved 31: Reserved.			•

Module no.	Name	Data type	Unit	Description	CR Monitor	CRE pump	MP 204 + CR
12	ControllerFaults	5	bits	**Bits Description** 0: Reserved 1: FLASH parameter verification error (code 83) 2: Ethernet: No IP address from DHCP server (code 231) 3: Ethernet: Auto-disabled due to misuse (code 232) 4: Reserved 5: Reserved 6: Reserved 7: Reserved.	•		
13	NumberOfStarts	8	1	Number of pump starts.		•	
14	OperationTime	8	hour	Total number of operating hours of the pump.		•	
15	MotorCurrent	8	A	Pump-motor current.		•	
16	ActualSetpoint	8	%	Selected system control loop reference. This is the setpoint that the system is currently using (in percent).		•	
17	TotalPoweredTime	8	hour	Auxiliary sensor input for miscellaneous measurements. Requires a sensor.		•	
18	Energy	8	W/h	Accumulated electric energy consumption of the system.		•	
19	MotorTemp	8	°C	Motor winding temperature.		•	
20	InletPressure	8	bar	Inlet pressure if a pressure sensor is installed at the inlet and configured.		•	
21	OutletPressure	8	bar	Discharge pressure measured by a pressure sensor.		•	
22	DiffPressureCalculated	8	bar	Value calculated by a mathematical model. Is used in conjunction with the measured differential pressure.		•	
23	DiffPressureMeasured	8	bar	Actual differential pressure across the pump. If the difference between the calculated and the measured values become too large, the pump may need service. It is possible to set a warning and an alarm level in the CR Monitor so that the user can be notified.		•	
24	VolumeFlow	8	m^3/h	Flow through the system as estimated or measured.		•	
25	PumpLiquidTemp	8	°C	Pumped-liquid temperature, e.g. water temperature.		•	
26	AuxSensorInput	8	%	Auxiliary sensor input for miscellaneous measurements. Requires a sensor.		•	
27	MotorVoltage	8	V	Phase-to-phase voltage of the motor.		•	
28	Frequency	8	Hz	Actual control signal (frequency) applied to the pump motor.		•	
29	Speed	8	rpm	Speed of the pump motor in rotations per minute.		•	
30	EfficiencyCalculated	8	%	Value calculated by a mathematical model. Is used in conjunction with the measured efficiency.	•		
31	EfficiencyMeasured	8	%	Actual efficiency of the pump. If the difference between the calculated and the measured values become too large, the pump may need service. It is possible to set a warning and an alarm level in the CR Monitor so that the user can be notified.	•		
32	PowerCalculated	8	W	Value calculated by a mathematical model. Is used in conjunction with the measured power.	•		
33	PowerMeasured	8	W	Actual power of the pump. If the difference between the calculated and the measured values become too large, the pump may need service. It is possible to set a warning and an alarm level in the CR Monitor so that the user can be notified.		•	
34	NPSHAvailable	8	m	Current Net Positive Suction Head for the pump. Must always be larger than the required NPSH to avoid cavitation and thereby unnecessary wear of the pump.	•		
35	NPSHRequired	8	m	Net Positive Suction Head required by the pump.	•		
36	CavitationMargin	8	m	Margin before the pump will cavitate. (NPSHRequired – NPSHAvailable).	•		
37	DigitalInput	5	unscaled	Status of the external digital inputs. Bit 0 is digital input 1, and bit 1 is digital input 2, etc. If the bit reads logical 0, the input is at 0 V. If the bit reads 1, the digital input is at 5 V.	•		
38	DigitalOutput	5	unscaled	Status of the external digital outputs. Bit 0 is digital output 1, and bit 1 is digital output 2, etc. If the bit reads logical 0, the output is at 0 V. If the bit reads 1, the digital output is at 5 V.	•		

9. Fault finding

9.1 LED Status

Faults in a CIM/CIU 150 can be detected by observing the status of the two communication LEDs. See the table below.

Fault (LED status)	Possible cause	Remedy
1. Both LEDs (LED1 and LED2) remain off when the power supply is connected and 5 seconds have passed.	a) The CIU 150 is defective.	• Replace the CIU 150.
2. The LED for internal communication (LED2) is flashing red.	a) No internal communication between the CIU 150 and the Grundfos CR Monitor.	• Check the cable connection between the CR Monitor and the CIU 150. • Check that the individual conductors have been fitted correctly. • Check the power supply to the CR Monitor.
3. The LED for internal communication (LED2) is constantly red.	a) The CIU 150 does not support the CR Monitor connected.	• Contact the nearest Grundfos company.
4. The Profibus LED (LED1) is constantly red.	a) Fault in the CIU 150.	• Contact the nearest Grundfos company.
5. The Profibus LED (LED1) is flashing red.	a) Fault in the CIU 150 Profibus configuration.	• Check that the Profibus address (switches SW3 and SW4) have a valid value (1-126). See section *4.2 Setting the Profibus address*. • Check that the GSD file used is correct. • Check that the Profibus cable has been fitted correctly. • Check that the Profibus termination is correct. See section *4.3 Termination resistors*.

9.2 Diagnostics

Besides WarningCode and FaultCode, the device can also actively send information about its own state. Diagnostics are important information which an automation system can use to initiate corrective measures.

To transmit diagnostic information, the standard mechanisms of the Profibus DP are used, and messages are actively sent to the class 1 master. Profibus DP provides a protocol to transmit information to the class 1 master with a higher priority than the user data.

9.2.1 Structure of diagnostic message

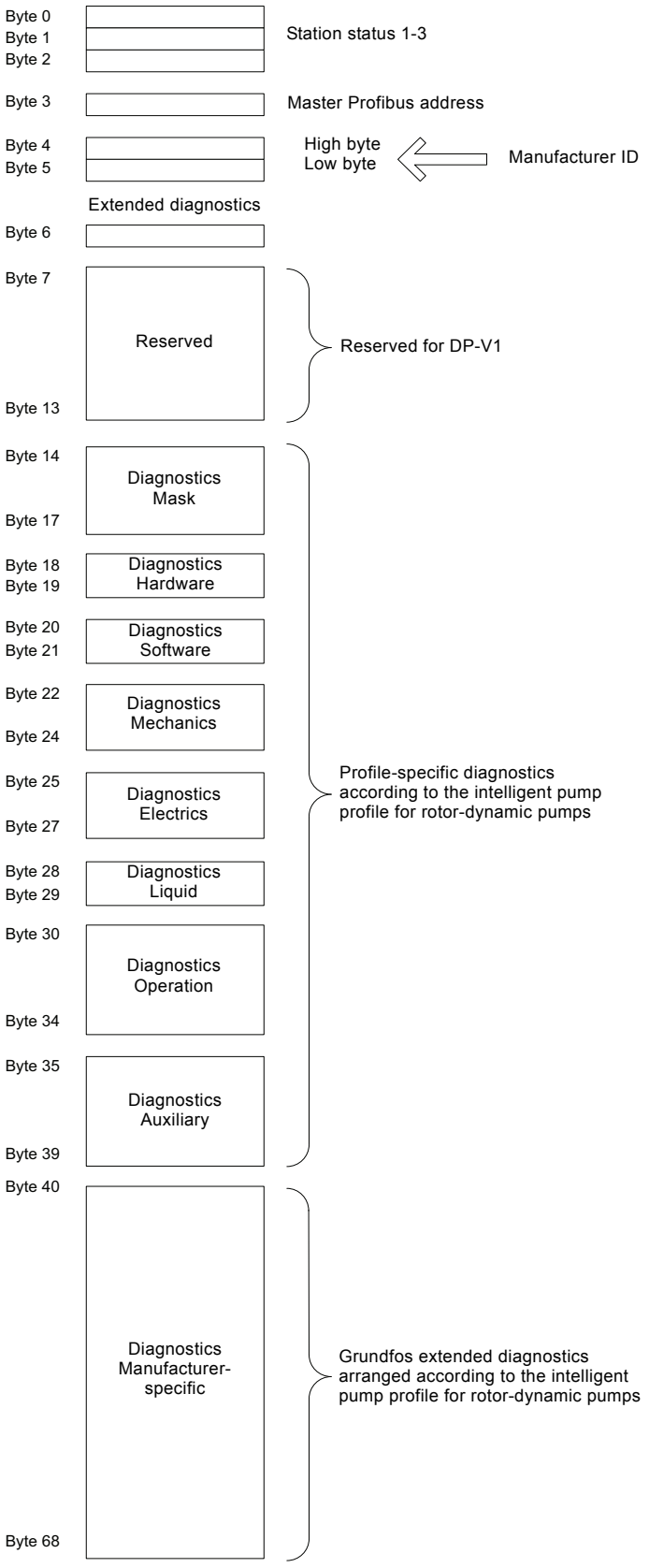


Fig. 15 Diagnostic message

9.2.2 Station status

The station status 1 to 3 provide an overview of the status of a DP slave.

Structure of station status 1 (byte 0)

Byte	Bit	Meaning of "1"	Remedy
0	0	The DP slave cannot be addressed by the DP master. The bit in the DP slave is always 0.	• Is the correct Profibus address set on the DP slave? • Bus connector/FOC connected? • Voltage on DP slave? • RS-485 repeater set correctly? • Has a reset been performed on the DP slave (switch off/switch off)?
	1	The DP slave is not ready for the data exchange.	• Wait for the DP slave to complete start-up.
	2	The configuration data sent to the DP slave by the DP master does not match the actual configuration of the DP slave.	• Correct station type or correct configuration of the DP slave entered in the configuration software?
	3	External diagnostics available.	• Evaluate the identifier-related module status and/or channel-related diagnosis. As soon as all errors are remedied, bit 3 is reset. The bit is reset when there is a new diagnostic message in the bytes of the diagnostics indicated above.
	4	The requested function is not supported by the DP slave.	• Check the configuration.
	5	The DP master cannot interpret the response of the DP slave.	• Check the bus configuration.
	6	The DP slave type does not correspond to the software configuration.	• Was the configuration software set for the correct station type?
	7	The DP slave was configured by a different DP master (not by the DP master that currently has access to the DP slave).	• The bit is always 1, for example, if you access the DP slave with the programming device or another DP master. The Profibus address of the DP master that configured the DP slave is located in the "Master Profibus address" diagnostic byte.

Structure of station status 2 (byte 1)

Byte	Bit	Meaning of "1"
1	0	The DP slave must be re-configured.
	1	The slave is in start-up phase.
	2	The bit in the DP slave is always 1.
	3	Response monitoring has been enabled for this DP slave.
	4	The DP slave has received the "FREEZE" control command.
	5	The DP slave has received the "SYNC" control command.
	6	The bit is always 0.
	7	The DP slave is deactivated, i.e. it has been removed from the current processing.

Structure of station status 3 (byte 2)

Byte	Bit	Meaning of "1"
2	0 to 6	The bits are always 0.
	7	There are more channel-specific diagnostic messages than can be represented in the diagnostic frame.

9.2.3 Master Profibus address

The Profibus address of the DP master is stored in the master Profibus address diagnostic byte

- which the DP slave has configured and
- which has read- and write-access to the DP slave.

The master Profibus address is located in byte 3 of the slave diagnosis.

FF_H in byte 3

If the FF_H value in byte 3 is given as the master Profibus address, the DP slave is not configured by the DP master.

9.2.4 Manufacturer ID

The manufacturer ID contains a code that describes the type of the DP slave.

Byte 4	Byte 5	Manufacturer ID for
$0B_H$	$5A_H$	CIU/CIM 150 – Pump
$0B_H$	59_H	CIU/CIM 150 – CR Monitor

9.2.5 Extended diagnostics

Byte 6 is the number of bytes following including byte 6.

Byte 6 has this structure:

Bit	7	6	5	4	3	2	1	0
	Always 0		Number of extended diagnostic bytes (0-63)					

Byte 6 always has the value $\mathbf{33_H}$.

9.2.6 Diagnostics Mask

This is part of the Profibus profile for intelligent pumps from Profibus International. This mask is used to specify the structure of the extended diagnostics.

Unsupported bits are read as 0.

Structure of Diagnostics Mask

Byte	Bit	Meaning of "1"
14	0	0
	1	0
	2	0
	3	0
	4	0
	5	0
	6	0
	7	0
Byte	**Bit**	**Meaning of "1"**
15	0	0
	1	0
	2	0
	3	0
	4	0
	5	0
	6	0
	7	0
Byte	**Bit**	**Meaning of "1"**
16	0	0
	1	0
	2	0
	3	0
	4	0
	5	0
	6	0
	7	0
Byte	**Bit**	**Meaning of "1"**
17	0	EXTENSION_AVAILABLE
	1	DIA_AUX_DEVICE
	2	DIA_OPERATION
	3	DIA_PROC_LIQUID
	4	DIA_ELECTRICS
	5	DIA_MECHANICS
	6	DIA_SOFTWARE
	7	DIA_HARDWARE

9.2.7 Diagnostics Hardware

Additional diagnostic information about the device, related to the device hardware. More than one message possible at the same time.

Only the bits supported by Grundfos are shown.

Unsupported bits are read as 0.

Structure of Diagnostics Hardware

Byte	Bit	Meaning of "1"	Cause
18	0	0	
	1	0	
	2	0	
	3	0	
	4	MeasureCircuit	Indicates a failure in the measurement elements of the device hardware.
	5	0	
	6	Communication	Indicates a communication fault.
	7	0	
19	0	0	
	1	0	
	2	0	
	3	0	
	4	0	
	5	0	
	6	0	
	7	Manufacturer-specific diagnostic information	Indicates additional manufacturer-specific hardware diagnostics in the manufacturer-specific area.

9.2.8 Diagnostics Software

Additional diagnostic information about the device, related to the device software. More than one message possible at the same time.

Only the bits supported by Grundfos are shown.

Unsupported bits are read as 0.

Structure of Diagnostics Software

Byte	Bit	Meaning of "1"	Cause
20	0	SoftwareFault	Indicates a failure of device software.
	1	0	
	2	0	
	3	0	
	4	0	
	5	0	
	6	0	
	7	0	
21	0	0	
	1	0	
	2	0	
	3	0	
	4	0	
	5	0	
	6	0	
	7	Manufacturer-specific diagnostic information	Indicates additional manufacturer-specific software diagnostics in the manufacturer-specific area.

9.2.9 Diagnostics Mechanics

Additional diagnostic information about the device, related to the device mechanics. More than one message possible at the same time.

Only the bits supported by Grundfos are shown.

Unsupported bits are read as 0.

Structure of Diagnostics Mechanics

Byte	Bit	Meaning of "1"	Cause
22	0		
	1	RotorBlocked	Indicates a blocked rotor.
	2	ExcessVibration	Indicates unacceptably high mechanical vibration.
	3	BearingFault	Indicates a generic bearing failure.
	4	0	
	5	0	
	6	0	
	7	0	
23	0	0	
	1	0	
	2	0	
	3	0	
	4	0	
	5	0	
	6	0	
	7	0	
24	0	0	
	1	0	
	2	0	
	3	0	
	4	0	
	5	0	
	6	0	
	7	Manufacturer-specific diagnostic information	Indicates additional manufacturer-specific software diagnostics in the manufacturer-specific area.

9.2.10 Diagnostics Electrics

Additional diagnostic information about the device, related to the device electrics. More than one message possible at the same time.

Only the bits supported by Grundfos are shown.

Unsupported bits are read as 0.

Structure of Diagnostics Electrics

Byte	Bit	Meaning of "1"	Cause
25	0	0	
	1	InstallationFault	Indicates an unacceptable electrical installation, e.g. mixed-up phases.
	2	0	
	3	SupplyVoltHigh	Indicates too high supply voltage.
	4	SupplyVoltLow	Indicates too low supply voltage.
	5	0	
	6	SupplyCurrHigh	Indicates too high supply current.
	7	0	
26	0	0	
	1	0	
	2	0	
	3	PhaseFailure	Indicates a phase failure, e.g. missing phase.
	4	0	
	5	CurrentInDevice	Indicates unacceptable current inside the device.
	6	0	
	7	0	
27	0	0	
	1	InsulationResist	Indicates an unacceptably low winding resistance.
	2	0	
	3	0	
	4	0	
	5	0	
	6	0	
	7	Manufacturer-specific diagnostic information	Indicates additional manufacturer-specific software diagnostics in the manufacturer-specific area.

9.2.11 Diagnostics Liquid

Additional diagnostic information about the device, related to the device liquid. More than one message possible at the same time.

Only the bits supported by Grundfos are shown.

Unsupported bits are read as 0.

Structure of Diagnostics Liquid

Byte	Bit	Meaning of "1"	Cause
28	0	0	
	1	Cavitation	Indicates cavitation of the pumped liquid.
	2	0	
	3	Dry	Indicates dry running.
	4	0	
	5	0	
	6	0	
	7	Temperature	Indicates an abnormal temperature of the pumped liquid.
29	0	0	
	1	0	
	2	0	
	3	0	
	4	0	
	5	0	
	6	0	
	7	Manufacturer-specific diagnostic information	Indicates additional manufacturer-specific software diagnostics in the manufacturer-specific area.

9.2.12 Diagnostics Operation

Additional diagnostic information about the device, related to the device operation. More than one message possible at the same time.

Only the bits supported by Grundfos are shown.

Unsupported bits are read as 0.

Structure of Diagnostics Operation

Byte	Bit	Meaning of "1"	Cause
30	0	0	
	1	0	
	2	TurbineOp	Indicates that the pump is working as a turbine (reverse flow).
	3	0	
	4	0	
	5	0	
	6	0	
	7	0	
31	0	0	
	1	0	
	2	0	
	3	0	
	4	0	
	5	0	
	6	0	
	7	0	
32	0	0	
	1	0	
	2	0	
	3	Lubricant	Indicates a problem with the lubricant.
	4	0	
	5	0	
	6	0	
	7	0	
33	0	0	
	1	OverLoad	Indicates overload.
	2	0	
	3	0	
	4	Leakage	Indicates a leakage problem, e.g. leakage of the mechanical shaft seal.
	5	TemperatureFault	Indicates a generic temperature problem of the pump.
	6	0	
	7	0	
34	0	0	
	1	0	
	2	MotorOverheat	Indicates overheating of the motor.
	3	ContrOverheat	Indicates overheating of the controller.
	4	ConvOverheat	Indicates overheating of the converter.
	5	0	
	6	0	
	7	Manufacturer-specific diagnostic information	Indicates additional manufacturer-specific software diagnostics in the manufacturer-specific area.

9.2.13 Diagnostics Auxiliary

Additional diagnostic information about the device, related to the device auxiliary. More than one message possible at the same time.

Only the bits supported by Grundfos are shown.

Unsupported bits are read as 0.

Structure of Diagnostics Auxiliary

Byte	Bit	Meaning of "1"	Cause
35	0	AuxDeviceFault	Indicates a generic failure of an auxiliary device.
	1	0	
	2	0	
	3	0	
	4	0	
	5	0	
	6	0	
	7	0	
36	0	0	
	1	0	
	2	0	
	3	0	
	4	0	
	5	0	
	6	0	
	7	0	
37	0	0	
	1	0	
	2	0	
	3	0	
	4	0	
	5	0	
	6	0	
	7	0	
38	0	0	
	1	0	
	2	0	
	3	0	
	4	0	
	5	0	
	6	0	
	7	0	
39	0	0	
	1	0	
	2	0	
	3	0	
	4	0	
	5	0	
	6	0	
	7	Manufacturer-specific diagnostic information	Indicates additional manufacturer-specific software diagnostics in the manufacturer-specific area.

9.2.14 Diagnostics Manufacturer-specific

Additional diagnostic information about the device, related to the manufacturer-specific diagnostics. More than one message possible at the same time.

Structure of Diagnostics Manufacturer-specific

Byte	Bit	Meaning of "1"
40	0	Missing phase
	1	Too many restarts (from standby mode per 24 hours)
	2	Regenerative braking
	3	Mains fault
	4	Too many hardware shutdowns (short standbys per minute)
	5	PWM switching frequency reduced
	6	Water-in-oil fault (motor oil)
	7	Humidity analog alarm
41	0	Electronic DC-link protection activated (ERP)
	1	Main system (SCADA) communication fault
	2	Other
	3	Performance requirement cannot be met
	4	Commanded alarm standby (trip)
	5	Diaphragm break (dosing pump)
	6	Too many starts per hour
	7	Humidity switch alarm
42	0	Smart trim gap alarm
	1	Setup conflict
	2	Load continues even if the motor has been switched off
	3	External motor protector activated (e.g. MP 204)
	4	Battery low
	5	Change varistor(s) (specific service information)
	6	Automatic motor model recognition failed
	7	Undervoltage transient
43	0	Cut-in fault (dV/dt)
	1	Voltage asymmetry
	2	Motor protection function, general shutdown (mpf)
	3	Slip high
	4	Kipped motor
	5	Motor protection function 3 sec. limit
	6	Motor current protection activated (MCP)
	7	Electronic rectifier protection activated (ERP)
44	0	Electronic inverter protection activated (EIP)
	1	Underload
	2	Low flow
	3	No flow
	4	Thermal relay 1 in motor (e.g. Klixon)
	5	Thermal relay 2 in motor (e.g. thermistor)
	6	Motor temperature 2 (Pt100, t_mo2)
	7	Motor temperature 3 (Pt100, t_mo3)

Byte	Bit	Meaning of "1"
45	0	Pump bearing temperature high (Pt100), in general or in top bearing
	1	Pump bearing temperature high (Pt100), middle bearing
	2	Pump bearing temperature high (Pt100), bottom bearing
	3	Motor bearing temperature high (Pt100), drive end (DE)
	4	Motor bearing temperature high (Pt100), non-drive end (NDE)
	5	Hardware fault type 1
	6	Hardware shutdown (HSD)
	7	Internal supply voltage too high
46	0	Internal supply voltage too low
	1	Internal communication failure
	2	Twin-head pump communication failure
	3	Speed plug fault
	4	Add-on module functional fault
	5	Add-on module communication fault
	6	Analog output fault
	7	Display communication fault
47	0	Inrush fault
	1	Internal communication failure in frequency converter
	2	Real-time clock out of order
	3	Hardware fault type 2
	4	Data area verification error (RAM)
	5	Code area verification error (ROM, FLASH)
	6	FE parameter area verification error (EEPROM)
	7	Memory access error
48	0	BE parameter area verification error (EEPROM)
	1	Sensor fault
	2	Sensor 1 feedback signal fault
	3	Rpm sensor signal fault
	4	Temperature 1 sensor signal fault
	5	(Feedback) sensor calibration fault
	6	Sensor 2 signal fault
	7	Sensor 1 limit exceeded
49	0	Sensor 2 limit exceeded
	1	Pressure sensor signal fault
	2	Flow sensor signal fault
	3	Water-in-glycol sensor signal fault
	4	Humidity sensor signal fault
	5	Atmospheric pressure sensor signal fault
	6	Rotor position sensor fault (Hall sensor)
	7	Rotor origo sensor fault
50	0	Temperature 2 sensor signal fault (t_mo2)
	1	Temperature 3 sensor signal fault (t_mo3)
	2	Smart trim gap sensor signal fault
	3	Vibration sensor signal fault
	4	Pump bearing temperature sensor (Pt100) signal fault, in general or in top bearing
	5	Pump bearing temperature sensor (Pt100) signal fault, middle bearing
	6	PTC sensor signal fault (short-circuited)
	7	Pump bearing temperature sensor (Pt100) signal fault, bottom bearing

Byte	Bit	Meaning of "1"
51	0	Extra temperature sensor signal fault
	1	General-purpose sensor signal fault
	2	Unknown sensor type
	3	Sensor limit 1 exceeded
	4	Sensor limit 2 exceeded
	5	Sensor limit 3 exceeded
	6	Sensor limit 4 exceeded
	7	Sensor limit 5 exceeded
52	0	Sensor limit 6 exceeded
	1	Reference input fault
	2	Reference (setpoint) input signal fault
	3	Reference influence input signal fault
	4	Reference attenuator input signal fault
	5	Software shutdown request
	6	Skew load
	7	Current asymmetry
53	0	Cos φ too high
	1	Cos φ too low
	2	Auxiliary winding fault (single-phase motors)
	3	Auxiliary winding current too high (single-phase motors)
	4	Auxiliary winding current too low (single-phase motors)
	5	Start capacitor too low (single-phase motors)
	6	Run capacitor too low (single-phase motors)
	7	Application alarm
54	0	External sensor input high
	1	External sensor input low
	2	All pumps in alarm
	3	Inconsistency between sensors
	4	Level float switch sequence inconsistency
	5	Water shortage (level 1)
	6	Non-return valve fault
	7	Overpressure
55	0	Underpressure
	1	Diaphragm tank pre-charge pressure out of range
	2	VFD not ready
	3	Water shortage (level 2)
	4	Soft pressure build-up timeout
	5	Pilot pump alarm
	6	General-purpose sensor high alarm
	7	General-purpose sensor low alarm
56	0	Pressure relief not adequate
	1	Network alarm
	2	Ethernet: No IP address from DHCP server
	3	Ethernet: Auto-disabled due to misuse
	4	Ethernet: IP address conflict
	5	Time for service (general service information)
	6	Communication Interface Module (CIM) fault
	7	

10. Grundfos alarm and warning codes

Code	Description
1	Leakage current
2	Missing phase
3	External fault signal
4	Too many restarts (from standby mode per 24 hours)
5	Regenerative braking
6	Mains fault
7	Too many hardware shutdowns (short standbys per minute)
8	PWM switching frequency reduced
9	Phase sequence reversal
10	Pump communication fault
11	Water-in-oil fault (motor oil)
12	Time for service (general service information)
13	Humidity analog alarm
14	Electronic DC-link protection activated (ERP)
15	Main system (SCADA) communication fault
16	Other
17	Performance requirement cannot be met
18	Commanded alarm standby (trip)
19	Diaphragm break (dosing pump)
20	Insulation resistance low
21	Too many starts per hour
22	Humidity switch alarm
23	Smart trim gap alarm
24	Vibration
25	Setup conflict
26	Load continues even if the motor has been switched off
27	External motor protector activated (e.g. MP 204)
28	Battery low
29	Turbine operation (impellers forced backwards)
30	Change bearings (specific service information)

Code	Description
31	Change varistor(s) (specific service information)
32	Overvoltage
40	Undervoltage
41	Undervoltage transient
42	Cut-in fault (dV/dt)
45	Voltage asymmetry
48	Overload
49	Overcurrent (i_line, i_dc, i_mo)
50	Motor protection function, general shutdown (mpf)
51	Blocked motor/pump
52	Slip high
53	Kipped motor
54	Motor protection function 3 sec. limit
55	Motor current protection activated (MCP)
56	Underload
57	Dry running
58	Low flow
59	No flow
64	Overtemperature
65	Motor temperature 1 (t_m or t_mo or t_mo1)
66	Control electronics temperature (t_e)
67	Power converter temperature (t_m)
68	External temperature / water temperature (t_w)
69	Thermal relay 1 in motor (e.g. Klixon)
70	Thermal relay 2 in motor (e.g. thermistor)
71	Motor temperature 2 (Pt100, t_mo2)
72	Hardware fault type 1
73	Hardware shutdown (HSD)
74	Internal supply voltage too high
75	Internal supply voltage too low

Code	Description
76	Internal communication failure
77	Twin-head pump communication fault
78	Speed plug fault
79	Add-on module functional fault
80	Hardware fault type 2
81	Data area verification error (RAM)
82	Code area verification error (ROM, FLASH)
83	FE parameter area verification error (EEPROM)
84	Memory access error
85	BE parameter area verification error (EEPROM)
88	Sensor fault
89	Sensor 1 feedback signal fault
90	RPM sensor signal fault
91	Temperature 1 sensor signal fault
92	(Feedback) sensor calibration fault
93	Sensor 2 signal fault
94	Sensor 1 limit exceeded
95	Sensor 2 limit exceeded
96	Reference input fault
97	Reference (setpoint) input signal fault
98	Reference influence input signal fault
99	Reference attenuator input signal fault
104	Software shutdown request
105	Electronic rectifier protection activated (ERP)
106	Electronic inverter protection activated (EIP)
110	Skew load
111	Current asymmetry
112	Cos φ too high
113	Cos φ too low
120	Auxiliary winding fault (single-phase motors)

Code	Description
121	Auxiliary winding current too high (single-phase motors)
122	Auxiliary winding current too low (single-phase motors)
123	Start capacitor too low (single-phase motors)
124	Run capacitor too low (single-phase motors)
144	Motor temperature 3 (Pt100, t_mo3)
145	Bearing temperature high (Pt100) in general or in top bearing
146	Bearing temperature high (Pt100) in middle bearing
147	Bearing temperature high (Pt100) in bottom bearing
148	Motor bearing temperature high (Pt100) in drive end (DE)
149	Motor bearing temp. high (Pt100) in non-drive end (NDE)
152	Add-on module communication fault
153	Analog output fault
154	Display communication fault
155	Inrush fault
156	Internal communication failure in frequency converter
157	Real-time clock out of order
158	Hardware circuit measurement fault
159	Communication Interface Module (CIM) fault
160	GSM modem SIM card fault
168	Pressure sensor signal fault
169	Flow sensor signal fault
170	Water in oil (WIO) sensor signal fault
171	Humidity sensor signal fault
172	Atmospheric pressure sensor signal fault
173	Rotor position sensor fault (Hall sensor)
174	Rotor origo sensor fault
175	Temperature 2 sensor signal fault (t_mo2)
176	Temperature 3 sensor signal fault (t_mo3)
177	Smart trim gap sensor signal fault
178	Vibration sensor signal fault
179	Bearing temp. sensor (Pt100) sig. fault, general or top bear.

Code	Description
180	Bearing temp. sensor (Pt100) signal fault, middle bear.
181	PTC sensor signal fault (short-circuited)
182	Bearing temperature sensor (Pt100) signal fault, bottom bearing
183	Extra temperature sensor signal fault
184	General-purpose sensor signal fault
185	Unknown sensor type
186	Power meter sensor signal fault
187	Energy meter signal fault
190	Sensor limit 1 exceeded (e.g. alarm level in WW application)
191	Sensor limit 2 exceeded (e.g. high level in WW application)
192	Sensor limit 3 exceeded (e.g. overflow level in WW applic.)
193	Sensor limit 4 exceeded
194	Sensor limit 5 exceeded
195	Sensor limit 6 exceeded
196	Operation with reduced efficiency
197	Operation with reduced pressure
198	Operation with increased power consumption
199	Process out of range (monitoring/ estimation/calculation/control)
200	Application alarm
201	External sensor input high
202	External sensor input low
203	All pumps in alarm
204	Inconsistency between sensors
205	Level float switch sequence inconsistency
206	Water shortage (level 1)
207	Water leakage
208	Cavitation
209	Non-return valve fault
210	Overpressure
211	Underpressure
212	Diaphragm tank pre-charge pressure out of bounds

Code	Description
213	VFD not ready
214	Water shortage (level 2)
215	Soft pressure build-up timeout
216	Pilot pump alarm
217	General-purpose sensor high alarm
218	General-purpose sensor low alarm
219	Pressure relief not adequate
220	Motor contactor feedback fault
221	Mixer contactor feedback fault
222	Mixer service time
223	Maximum number of mixer starts per hour exceeded
224	Pump fault (due to auxiliary component or general fault)
225	Distributed pump module communication fault
226	Distributed I/O module communication fault
227	Combi event
230	Network alarm
231	Ethernet: No IP address from DHCP server
232	Ethernet: Auto-disabled due to misuse
233	Ethernet: IP address conflict
240	Lubricate bearings (specific service information)
241	Motor phase failure
242	Automatic motor model recognition failed
243	Motor relay has been forced (manually operated/commanded)
244	On/Off/Auto switch fault
245	Pump continuous runtime too high
246	Customer relay has been forced (manually operated/commanded)
247	Power on notice (device/system has been switched off)
248	Battery/UPS fault

11. Profibus address

Profibus address	SW3	SW4
1	0	1
2	0	2
3	0	3
4	0	4
5	0	5
6	0	6
7	0	7
8	0	8
9	0	9
10	0	A
11	0	B
12	0	C
13	0	D
14	0	E
15	0	F
16	1	0
17	1	1
18	1	2
19	1	3
20	1	4
21	1	5
22	1	6
23	1	7
24	1	8
25	1	9
26	1	A
27	1	B
28	1	C
29	1	D
30	1	E
31	1	F
32	2	0
33	2	1
34	2	2
35	2	3
36	2	4
37	2	5
38	2	6
39	2	7
40	2	8
41	2	9
42	2	A
43	2	B
44	2	C
45	2	D

Profibus address	SW3	SW4
46	2	E
47	2	F
48	3	0
49	3	1
50	3	2
51	3	3
52	3	4
53	3	5
54	3	6
55	3	7
56	3	8
57	3	9
58	3	A
59	3	B
60	3	C
61	3	D
62	3	E
63	3	F
64	4	0
65	4	1
66	4	2
67	4	3
68	4	4
69	4	5
70	4	6
71	4	7
72	4	8
73	4	9
74	4	A
75	4	B
76	4	C
77	4	D
78	4	E
79	4	F
80	5	0
81	5	1
82	5	2
83	5	3
84	5	4
85	5	5
86	5	6
87	5	7
88	5	8
89	5	9
90	5	A

Profibus address	SW3	SW4
91	5	B
92	5	C
93	5	D
94	5	E
95	5	F
96	6	0
97	6	1
98	6	2
99	6	3
100	6	4
101	6	5
102	6	6
103	6	7
104	6	8
105	6	9
106	6	A
107	6	B
108	6	C
109	6	D
110	6	E
111	6	F
112	7	0
113	7	1
114	7	2
115	7	3
116	7	4
117	7	5
118	7	6
119	7	7
120	7	8
121	7	9
122	7	A
123	7	B
124	7	C
125	7	D
126	7	E

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